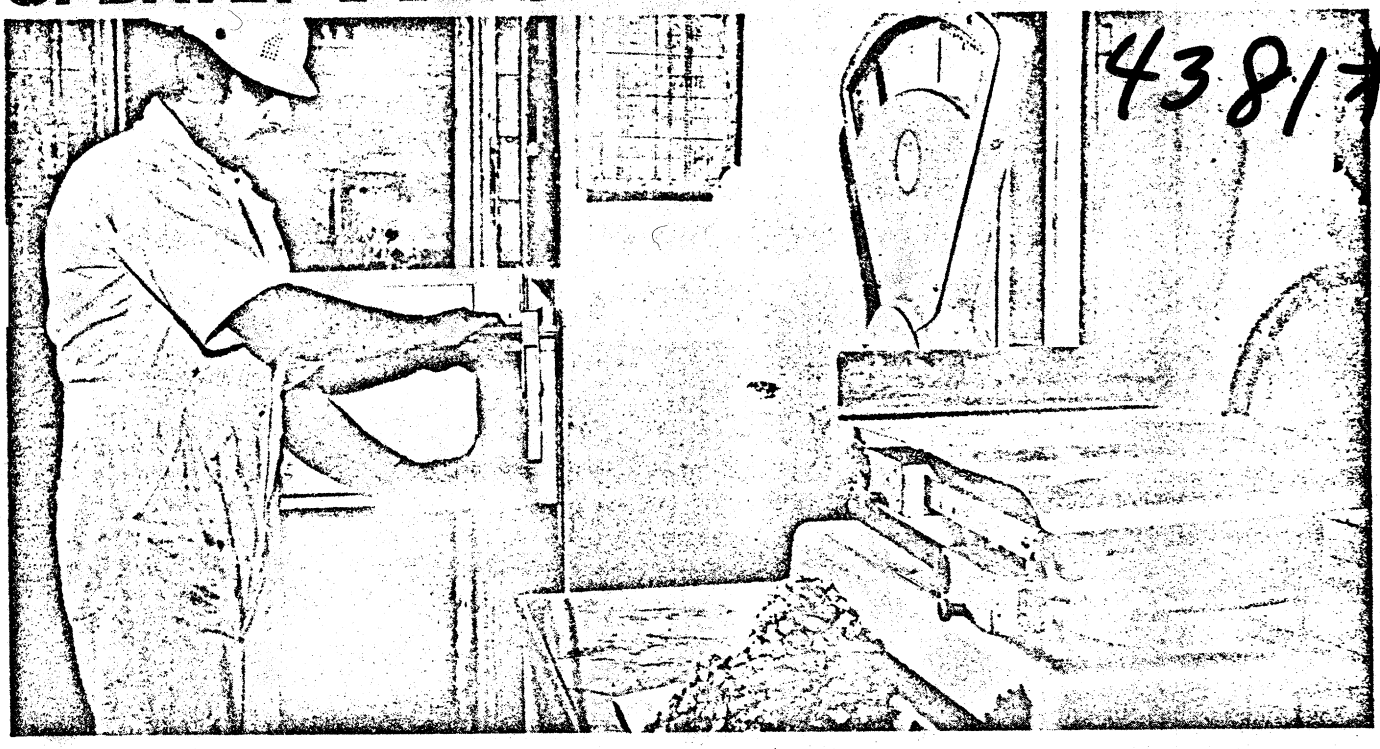
UPDATE: FAST ANALYSIS



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Rapid and accurate procedures to test for fat, protein and moisture–including a four minute moisture test using a domestic microwave oven.

RAPID methods for measuring moisture, fat and protein content in hamburger, sausage and processing meats are definite advantages in maintaining speed in automated and high volume production systems where they insure product uniformity.

That is why the goal at one research center is to evaluate and develop new methods of analysis that take less than 15 minutes and which produce results that are close to standard (AOAC) meat analytical procedures. This update on ongoing research at the USDA's Eastern Regional Research Center in Philadelphia, Pa., covers tests currently available to the industry that are rapid, accurate and economical.

They include a four-minute method for measuring moisture using a domestic microwave oven, a 7–10 minute method to determine the concentration of fat in meat and meat products by measuring specific gravity of a tetrachloroethylene extract, rapid fat analysis through absorbance of x-ray radiation, and a 15-minute meat protein determination through application of dye binding.

MOISTURE

Use of a microwave oven in determining moisture in beef and pork provides a rapid procedure that can be conducted in four minutes. It is accurate, precise and simple for moisture contents from 3.5–78%, and compares well with standard meat analytical procedures of the Association of Official Analytical Chemists (AOAC). In fact, compared with more lengthy AOAC methods, accuracy is within 0.1% and precision is within 0.6% moisture.

The test is most accurate and consistent when conducted on ground, fresh meats, regardless of their fat content. It is less consistent when conducted on emulsions.

For a sample test, use five grams ground fresh meat mixed with 22 grams sodium chloride and 1.9 grams ferrous oxide. To test larger quantities of meat, adjust the amounts of sodium chloride and ferrous oxide. For instance, to test 10 grams ground fresh meat, you would have to double the original quantity of sodium chloride and ferrous oxide.

Equipment needed for the test includes a domestic or household type microwave oven, a non-metallic bowl or dish to put the meat sample in, glass rods for mixing, and a scale that can weigh to plus or minus .02 grams.

Weigh a ground meat sample into a pre-weighed non-metallic vessel containing sodium chloride and ferrous oxide, and use short glass rods to mash and mix the sample and drying agents thoroughly. The salt helps to dehydrate the sample and prevents splattering during heating, while the ferrous oxide serves as an auxiliary heat generating agent.

The sample is then cooled one minute in the stream of the oven chamber air blower, and the vessel containing the residue is weighed to determine the loss in moisture due to heating. The percent moisture may be calculated by dividing the *loss* in weight of the heated meat sample by the weight of the meat sample before heating, and multiplying by 100.

Interlaboratory or collaborative tests that are prerequisites to method adoption by AOAC and ASTM are planned for this method as described and for an analyzer from Apollo Microwave Products that similarly employs microwave heating.

FAT

The Foss-Let method determines the concentration of fat from 5%–55% in meat and meat products in 7–10 minutes. Determinations using this method agree closely with those of the more lengthy empirical AOAC method, and precision is slightly better.

Results of research at the ERRC laboratory wi ' the Foss-Let fat analyzer method rrom Foss America, Inc. led to its adoption by AOAC and ASTM as an official standard method of analysis for fat.

This analytical procedure has potential use for small and medium size meat processors because the equipment is moderate in cost and simple to operate, in addition to being fast and accurate and not hazardous to the operator.

In order to conduct the test, in which fat determination is based on measurement of the specific gravity of a tetrachloroethylene extract, a meat sample is weighed and combined with a measured volume of tetrachloroethylene in a stainless steel container.

A known weight of anhydrous calcium sulfate is added to absorb moisture droplets.

The container is then sealed, placed in a mechanical orbital shaker for two minutes, and the contents are rapidly filtered. The specific gravity of this extract is measured in a magnetic float cell manually controlled by a digital readout potentiometer.

Readout values are converted to fat content by means of a chart.

Studies have also been initiated for rapid fat analysis in meat with an Anyl-Ray fat analyzer from Anyl-Ray Corp.

This instrumental method permits frequent nondestructive on-line analysis of meat fat content during processing. In order to conduct the test, a 13-lb. sample is placed in the analyzer chamber. Measurement is based on absorbance of X-ray radiation, which is directly proportional to the concentration of lean.

The result is read from a digital display meter within 10 seconds after radiation is commenced. Preliminary results of studies with this ultra-rapid method indicate that fat is determined with good accuracy and fair precision.

PROTEIN

ERRC is working on a 15-minute procedure for determining meat protein which involves further development of the application of dye binding as a convenient routine process control method.

In it acid orange 12 dye is used with established methodology and commercial equipment that is available from The Baltimore Spice Co.

A comparative analysis of this method on fresh meat, cured and smoked meat and emulsion products was made with the AOAC Kjeldahl standard method. In multi-laboratory studies on products ranging from 9% to 17% protein, the accuracy and precision of the method were evaluated.

The results indicate that the dye binding and Kjeldahl methods are equivalent in accuracy for protein in the meats, but not equivalent in emulsified meat products.

Based on current level of accuracy and precision and the need for a rapid, simple and economical method for the process control of protein, the dye binding method has been recommended to AOAC for adoption as a screening method. □